

### 983.1 GENERAL

This material shall consist of a homogeneous mixture of resins, plasticizers, fillers, pigments, and glass beads. The marking material shall be designed to adhere to bituminous and Portland cement concrete pavements. Type B cold applied plastic pavement marking will be used unless otherwise specified in the plans.

- A. Type A:** Type A reflectorized plastic pavement marking shall consist of a homogeneous, extruded, prefabricated, pliant polymer material of specified thickness and width, which shall contain abrasion resistant ceramic or ceramic coated beads bonded in a highly durable polyurethane topcoat. The material shall be fabricated with a patterned surface that presents a near vertical face to traffic to maximize retroreflectance. The pavement marking material shall be capable of being affixed to the pavement surface by means of a precoated, pressure sensitive adhesive.

An adhesive activator supplied by the manufacturer shall be utilized on applications of this material, except on newly installed asphalt when the surface temperature is 80° F (27° C) or above, or when the material is inlaid at the time asphalt is being installed.

- B. Type B:** Type B pavement marking shall consist of a homogeneous, wear resistant, conformable, retroreflective pliant polymer film with reflective glass spheres distributed throughout the base film. The pavement marking material shall be capable of being affixed to the pavement surface by utilizing a pressure sensitive precoated adhesive.

### 983.2 SPECIFIC REQUIREMENTS

#### A. Type A:

- 1. Reseal Test:** The plastic marking material shall reseal to itself when tested. Cut two 1" x 3" (two 25 mm x 75 mm) pieces of plastic. Overlap these pieces face to face for an area of one square inch (6.45 square centimeters) on a flat steel plate with the adhesive backing material remaining in place. Center a 2.2 lb (1 kg) weight over the one square inch (6.45 square centimeter) overlap area and place in an oven at 190° F (88° C) for one hour. After cooling to 77° F (25° C), the pieces shall be inseparable without tearing.
- 2. Pull Test:** The plastic shall require a pull of 8 to 20 pounds (35 to 89 Newton) to break. The elongation shall be no greater than 50 percent. The specimens for this test shall be Type 1 prepared in accordance with ASTM D 638. One inch square (6.45 square centimeter) pieces of carborundum extra coarse emery cloth or its equivalent, may be applied at each end of the test specimens to prevent the plastic adhesive from adhering to the test equipment. The break resistance shall be based on an average of at least 3 samples, and the rate of pull shall be ¼ inch (6.4 mm) per minute. This test shall be conducted at a temperature of 70° F to 80° F (21° C to 27° C).
- 3. Support Test:** A test specimen cut to dimension of one inch by six inch (25 mm x 150 mm) shall support a dead load of six pounds (26.7 Newtons) for 30 minutes. This test shall be conducted at a temperature of 70° F to 80° F (21° C to 27° C).

4. **Color:** The plastic marking material shall meet the color specification limits and luminance factors listed in Tables 1 and 2 when tested in accordance with ASTM E1347 or ASTM E1349. The plastic marking material shall maintain the color and luminance factors provided in the following tables throughout its service life.

Table 1

Color	Chromaticity Coordinates (corner points)								Luminance Factor (Y %)	
	X	Y	X	Y	X	Y	X	Y	Minimum	Maximum
White	0.355	0.355	0.305	0.305	0.285	0.325	0.335	0.375	35	
Yellow	0.560	0.440	0.490	0.510	0.420	0.440	0.460	0.400	25	
Red	0.480	0.300	0.690	0.315	0.620	0.380	0.480	0.360	6	15
Blue	0.105	0.100	0.220	0.180	0.200	0.260	0.060	0.220	5	14

Daytime Color Specification Limits and Luminance Factors for Pavement Markings Material with CIE 2° Standard Observer and 45/0 (0/45) Geometry and CIE Standard Illuminant D65

Table 2

Color	Chromaticity Coordinates (corner points)							
	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
White	0.480	0.410	0.430	0.380	0.405	0.405	0.455	0.435
Yellow	0.575	0.425	0.508	0.415	0.473	0.453	0.510	0.490

Nighttime Color Specification Limits for Pavement Marking Retroreflective Material With CIE 2° Standard Observer and Observation Angle = 1.05°, Entrance Angle + 88.76° and CIE Standard Illuminant A

## B. Type B:

1. **Composition:** The retroreflective pliant polymer pavement marking film shall consist of a mixture of quality polymeric materials, pigments, 1.5 index glass beads uniformly distributed throughout its cross-sectional areas and with a reflective layer of beads bonded to the top surface. These materials shall be composed as follows:

MATERIAL	MINIMUM PERCENT BY WEIGHT
Resins & Plasticizers	20
Pigments	30
Graded Glass Beads	33

2. **Tensile Strength:** The film shall have a minimum tensile strength of 40 pounds per square inch (275 kPa) when tested according to ASTM D 638. A sample of 6 inch x 1 inch x 0.06 inch (150 mm x 25 mm x 1.52 mm) shall be tested at a temperature between 70° F to 80° F (21° C to 27° C), using a jaw speed of 10 to 12 inches (250 mm to 300 mm) per minute.
3. **Elongation:** The film shall have a minimum elongation of 75 when tested according to ASTM D 638, using a jaw speed of 10 to 12 inches (250 mm to 300 mm) per minute.

4. **Plastic Pull Test:** A test specimen made the same size as in paragraph 2 shall support a dead load of four pounds (17.8 Newtons) for not less than 5 minutes at a temperature between 70° F to 80° F (21° C to 27° C).
5. **Pigmentation:** The pigments shall be selected and blended to provide a marking film that conforms to the requirements of Section 983.2.A.4.
6. **Glass Beads:** Glass beads shall be colorless and have a minimum index of refraction of 1.50 when tested using the liquid oil immersion method. The size and quality of the beads will be such that performance requirements for the retroreflective pliant polymer film shall be met. Bead adhesion shall be such that beads are not easily removed.

When a two inch by six inch (50 mm x 150 mm) sample is bent over a mandrel, with the two inch (50 mm) dimension perpendicular to the mandrel axis, microscopic examination of the area on the mandrel shall show no more than 10 percent of the beads with entrapment by the binder of less than 40 percent.

7. **Skid Resistance:** The surface of the retroreflective pliant polymer shall provide a minimum skid resistance value of BPN when tested according to ASTM E 303.
8. **Reflective Intensity:** The white and yellow film shall have the following initial reflective values at 0.2° and 0.5° observation angles measured in accordance with the photometric testing procedures of Federal Test Method Standard 370.

Reflective values shall be expressed as candlepower per foot candle per 5 square foot panel (2.236 ft. x 2.236 ft.) at an 86° entrance angle. The 5 square feet is derived from a standard stripe defined as 4" X 15' = 5 square feet.

	White		Yellow	
Observation Angle	0.20	0.50	0.20	0.50
Entrance Angle, 86°	0.20	0.15	0.15	0.10

9. **Reflectivity Retention:** The glass beads shall be strongly bonded and resistant to removal by traffic wear.

The material shall meet the following reflectivity retention test requirements:

- a. **Taber Abraser Simulation Test:** Using a taber abraser with an H-18 wheel and a 125 gram load, the sample shall be inspected to 50, 100, 150 and 200 cycles, under a microscope, to observe the extent and type of bead failure. No more than 15 percent of the beads shall be lost due to popout and the predominant mode of failure shall be wear down of the beads.
- b. **Qualitative Test:** Bead bond strengths shall be judged under a microscope with a magnification of at least five power. The beads shall be difficult to remove and when removed shall show a portion of the polymeric bead bond retained with the beads rather than clean removal from the sockets.